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**Food supply chain integrity: the need to go beyond certification**

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# Food supply chain integrity: the need to go beyond certification

## Abstract

**Purpose** – The main purpose of this study is to establish a conceptual model adopted from a Strategy-Structure-Performance paradigm for investigating the fit between the supply chain integration and halal food supply chain integrity and the impact of halal food supply chain integrity on firms' performance in a Malaysian context.

**Design/methodology/approach** – This study comprises a sample of a halal manufacturing firm in Malaysia. A cross-sectional research design was used in this study. Data were gathered based on mailed and personally administered questionnaires. SmartPLS was used to analyse the 254 valid responses.

**Findings** – The research findings indicate that internal integration and strategy have positive impact on halal food supply chain integrity. The study results confirmed that customer integration and supplier integration contributes to halal food supply chain integrity. It also finds that halal food supply chain integrity has a significantly positive impact.

**Research limitations/implications** – Our results suggested that a strategic collaboration with the supplier pivoted around the quality and integrity of the raw materials should be undertaken.

**Practical implications** – The results from this study supports that the managers should adopt all halal food supply chain integrity components to achieve a superior performance. Even though some of the components did not yield significant results in terms of their relationships with firms' performance, these dimensions were generally related to the standardised industry requirements, such as certifications.

**Originality/value** – The findings are original and unique and are based on established theories from the literature on supply chain management practices. The research findings are useful to academics and policymakers interested in fostering a halal supply chain in Malaysia.

**Keywords** Food integrity, food supply chain integrity, halal, supply chain integration

**Paper type** Research paper

## 1.0 Introduction

Prior to the last few decades, the food supply chain (SC) and predominantly localised and mostly consisted of the small- to medium-sized independent local businesses (Roth et al., 2008). The business concentration enables good visibility and control along the SC with lesser tiers of suppliers (Tse & Tan, 2011). The deliberation of food SC for only the targeted nearby market is due to the absence of technological infrastructures (i.e. transportation, cold warehousing, and food technologies) which restricts food from travelling longer distances. As a result of this, the

earlier SC is considered as the more effective SC network (Hearnshaw & Wilson, 2013). For example, the smaller market place permits higher attention to each specific product; hence the quality is always maintained as the production is largely based on more accurate sales forecasts. In addition, the SC concentration enables direct interaction between the sellers and the buyers, which facilitates the control on the food products' quality. A relatively more controlled marketplace minimises the risk of the members of SC to be opportunistic and violate the norms of the shared values and trust. Lyles et al. (2008) have argued that under conditions of trust, there is an expectation that the partners of the SC are capable of performing the tasks expected which is gained from the transparency of the business process by the food manufacturer.

Today, food SC has changed significantly. Globalisation has forced food to travel a greater distance and to be not only produced for local consumption. The longer food miles has involved more actors in the SC, lessened the transparency, and created more opportunities for the food to be adulterated, contaminated, or interfered with by irresponsible suppliers in the SC to gain substantial profit margins (Roth et al., 2008). However, the industry has responded by enforcing a controlling mechanism that aims to safeguard the food quality and integrity (Elliott, 2014; Halim and Salleh, 2012; Manning and Soon, 2014; Van der Spiegel et al., 2012; Tunçer, 2001) and thus increasing the trust of the consumers through labelling. Literature highlighted that certification and labelling play a significant role as a means of communication to the consumers in the food industry (Angulo and Gil, 2007; Bhaskaran et al., 2006; Magkos et al., 2006). However, a plethora of food scandals has hit the certified food products globally such as Malaysia's Cadbury pig DNA scandal (2014), the United Kingdom's horsemeat scandal (2013), the United States' salmonella outbreak in peanut butter (2008-2009) and China's melamine milk (2008). This has perplexed the reliability of the current control mechanisms. In addition, much literature has argued the effectiveness of certification in the food industry (e.g. Magkos et al., 2006; Powell et al., 2013; Roth et al., 2008). In short, the food manufacturer is required to be extra vigilant in ensuring their product is fulfilling the consumer expectations. Moreover, the food scandals have shaken consumers' confidence in the food they consumed and they have demanded stricter controls in food production. To date, the most current and emerging issues on food SC now is food integrity. Food integrity as highlighted by Elliott (2013) is food that not only encapsulates the issues of food safety and quality, but also the way

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3 it has been sourced, procured, and distributed – as well as the honest and accurate provision of information about  
4 those elements to consumers. Therefore, strengthening the argument of firms' individual certification is never  
5 sufficient in the era of inter-SC competition. However, the safeguarding measures being applied to all the players in  
6 the SC individually in ensuring the integrity of the food products, are shown by existing scandals indicate that the  
7 mechanism used is not sufficient and requires an additional manufacturing strategy in ensuring the integrity of the  
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17 This paper aims to address the shortcomings of current control mechanisms aimed at safeguarding food  
18 integrity, by exploring the possibilities of SC integration in enhancing the food integrity, extending the work of Donk et  
19 al. (2008) and Narasimhan and Kim (2002). Donk et al. (2008) explore the limitations and barriers for SC integration  
20 that is experienced by food manufacturers using a case study, which provided a suggestion that the idea of SC  
21 integration in the food industry need to be contested in a wider context. Narasimhan and Kim (2002) argue that  
22 research on SC integration need to examine specific aspects of the firm/industry. In a nutshell, the study aims to  
23 propose a conceptual model and adopt a partial least-square structural equation modelling (PLS-SEM) to test the  
24 effect empirically of SC integration on the efforts of safeguarding food integrity which, impacting the firms'  
25 performance, using data collected from 254 halal manufacturing firms in Malaysia. This research will provide  
26 evidence of the possibilities of SC integration in facilitating control of food integrity. Moreover, the research can also  
27 be a proof to the enforcer of the need for extra initiatives in safeguarding the complex issue of food integrity that  
28 requires the examination of the SC.  
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43 The rest of the paper is organised as follows. In Section 2, it reviews the literature on challenges on the  
44 modern halal food SC and the control mechanism shortfalls and how SC integration may help. Section 3 describes  
45 the methodologies used in the present study on in the halal food industry. Section 4 presents discussion on the result  
46 of that study, and Section 5 discusses the implications of these results, limitation and potential future research.  
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## 2.0 Literature review

### 2.1 Halal food SC challenges

Nowadays food manufacturers are formed into more structured entities, being considered as large-scale, capital intensive, mass producers of bulk products in large batches for low cost (Donk et al., 2008). Given this, the food manufacturers are also bound to the market demands that complicate the firms' aims of producing at the lowest cost. The situation has contributed towards the standardisation and certification of the food manufacturers in enabling them to trade in the intended market demand (i.e. halal, kosher and organic). However, the certification is voluntary and operationalised on the basis of individual firms not the SC of the product. The method has unintentionally put 'invisible walls' within the SC, and the responsibility of determining the quality within the factory that has stopped the initiatives of confirming the quality that has been substituted by the certification (Manzini and Accorsi, 2013). The claim may be rebuttable, but the example may be contextualised. To start with, ideally all the stakeholders in the SC should share the same aim when manufacturing food products. For halal food production, all players in SC are required to have ample understanding on the requirements and their dietary law. For instance, producing halal food (locally) in Muslim-majority countries such as Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and the United Arab Emirates is perceived to be much easier and straightforward. This point originates from Tajkarimi et al. (2013) who have noted that halal food inspection systems for these countries are based only on end-product testing and general hygienic and sanitation practices. But the risk of the other aspect of halal production in the SC, such as storage and food preservation, cooking methods, cleaning materials and GMP are often given minimal attention. It might be due to the existence of common understanding on halal that has become a means for Islamic devotion and sign of an identity reserved for the Muslim community (Bonne et al., 2007). Contrary to this, food inspection systems in multi-cultural countries such as Malaysia, Thailand and Indonesia or Muslim-minority countries are more thorough by inclusion of multiple standards compared to Muslim countries (Van der Spiegel et al., 2012).

The halal food industry in these countries (multi-racial and non-Muslim countries) has enforced legislation for all food manufacturers that intend to trade in the halal food market. In order to increase the applicability and effectiveness of the mechanism, the certification of competency is awarded on the basis of the firm. However, it is

difficult for the firm to go beyond the standard voluntary halal compliance (i.e. application of traceability tools such as RFID) which is expensive to be implemented in the total SC (Aung and Chang, 2014; Manzini and Accorsi, 2013; Regattieri et al., 2007). As such, the firms are more comfortable in concentrating on most of the quality assurance within their factories and which are still lawful to trade in the industry. The attentiveness creates the 'territorial responsibilities' in the SC. The territorial responsibilities in this context mean that the firms are only focusing on internal production by waiving other potential risks that may occur in the SC by relying fully on the certification. The decision has deteriorated the direct connection between the supplier and the buyers and limits the valuable transactional process between the firms. Seen in this light, it has been argued that lack of visibility in the SC increases the risk of the product recalls (Barratt & Oke, 2007; Roth et al., 2008; Tse & Tan, 2011; Williams et al., 2013). The seriousness of this point is epitomised by the 2013 horsemeat scandal investigation output which reached a dead end in finding the responsible actors, which has left the focal firm of being fully responsible.

The standards alone cannot guarantee the functionality within a particular firm or SC (Gotzamani, 2005; Sroufe & Curkovic, 2008), especially when the standard focuses on the production methods rather than the products (Polo-Redondo & Cambra-Fierro, 2008). Additionally, their applicability towards the complete food SC is arguable, as a specific standard is only ideal for a certain part of the SC (Trienekens and Zuurbier, 2008). Empirical evidence in previous research shows the relationship between the standards in ensuring performance (quality) is weak (Gotzamani, 2005; Prajogo, 2011). Similarly, Martinez-Costa et al. (2009) revisited the effects of multiple standards on performance and pointed out that the validity of the changes to performance is questionable.

Moreover, the standards and regulations on implementation mechanism are usually done through audits - the effectiveness of which is arguable. No audit can be considered to be successful unless there is a thorough understanding of how the constituent elements of an organisation interact with one another (people, processes and technology), (Fahmy Salama et al., 2009). Besides, the audit also depends upon the auditor's individual ability, which has a significant impact on the audit outcome as well as the scope or broadness of the audit in covering all operations and products (Powell et al., 2013). In practice, firms are complying with multiple standards and regulations, such as requiring audits periodically and having audits by third parties. The situation has made the firm



to be more inclined towards more “tolerable” audit firms, generating conflict for the audit firms to trade-off between the quality of the audit and their sustainability, which eventually may affect the authenticity of the certification. Moreover, certification using inspection as the method of assessment is claimed to be neither sustainable nor effective in the long run (Roth et al., 2008). On the other hand, there are no global consensus standards for halal food, which allows a variety of application and enforcement by the practitioners, resulting in equivocal production and integrity measures (Van der Spiegel et al., 2012). From the standpoint of food integrity, specific standards and regulations are constructed to address special dietary foods like halal, kosher, vegetarian and vegan, on top of general standards.

Distinguished entities in the industry have considerably increased the competition. Thus, in achieving competitive advantages, firms are trying to offer the same product at a lower price (Wong et al., 2011). Facilitated by reasonably more efficient logistics models emphasising on the sourcing beyond borders to reduce cost (importing) and generate revenue from a larger market (exporting) is one of the common ‘secret weapons’ in the SC context (Lyles et al., 2008; Roth et al., 2008). Globalised SCs further increase the complexity of halal food quality control. The halal food integrity risk is enormous when the suppliers or sub-suppliers are located overseas, especially in non-Muslim countries where there is involvement of non-Muslims, especially when globally accepted halal standards are absent (Halim and Salleh, 2012). Despite the existence of the mechanism in the SC, the weak links in multi-tier sourcing and higher-tier suppliers outsourced to sub-tier suppliers are still to be blamed as the causes of scandals. The case indicates that the long and wide (multiple products used for the production) SC has resulted in complicating the tracking of quality control in the SC (Lyles et al., 2008).

The trade-off between shifting competition to the intra-SC and the stagnancies of the standards in the firms inhibits the dynamism of the food industries. In general, increasing population has made market demands for food more complex and heterogenous, requiring that market-oriented activities should happen at every stage of the SC (Trienekens et al., 2012). However, the food industry requires a long forecast as the breeding and farming of the raw materials require a significant time for production. In the same essence, the disproportion between demand and production is highly expected and may lead to overproduction, higher inventory and even short production. Therefore,



a prolonged shelf-life of the food product is seen as the solution of this issue. In doing so, the introduction of artificial ingredients are introduced to the food manufacturing such as emulsifiers, colourings, and preservatives. The usage of these features in food production has created debates among Muslim scholars especially on the ingredients that have pork substances (Regenstein et al., 2003). In contrast, Lupien (2007) argues that it is tolerable for certain levels of contamination when eliminating the elements is impossible during the production of conventional food. Similarly, according to Magkos et al. (2006), it cannot be ruled out that organic food may not be pesticide free. Nevertheless, in halal food production, which is fundamentally required by religion, the quality leeway exemplified earlier is not permissible and breaches the trust of the consumers (Bonne & Verbeke, 2008; Campbell et al., 2011; Demirhan et al., 2012; Farouk, 2013; Karijn et al., 2007). Yet, the food contamination issues alone have been widely covered by debates in the echelons of SC, such as farming (Lupien, 2007; Tunçer, 2001) service (Corrêa et al., 2007; Luk and Layton, 2004), logistics (Talib & Johan, 2012) and consumer (Pivato et al., 2007). Thus, from this single-handed perspective, the position of the credence of quality food in the industry is in dilemma when the certification and trust are no longer sufficient.

*2.2 Supply Chain Integration*

Supply chain integration can be seen as a practice being applied by the firm in establishing strategic collaborations within and beyond the firm's ownership and span of control. One precaution taken by this study was based on the claim of Pagell (2004) who has noted that:

Many authors who have studied integration offer no formal definition of the construct. Finally, many authors do not explicitly address the construct but are clearly doing research that could be construed as concerning integration. The end result is that this commonly researched construct does not have a single, accepted definition or operationalisation (p.460).

In short, the definition of SC integration would depend on the research context (Basnet, 2013; Narasimhan and Kim, 2002). For the purpose of this study, the definition of SC integration was traced back to the origin of the SC

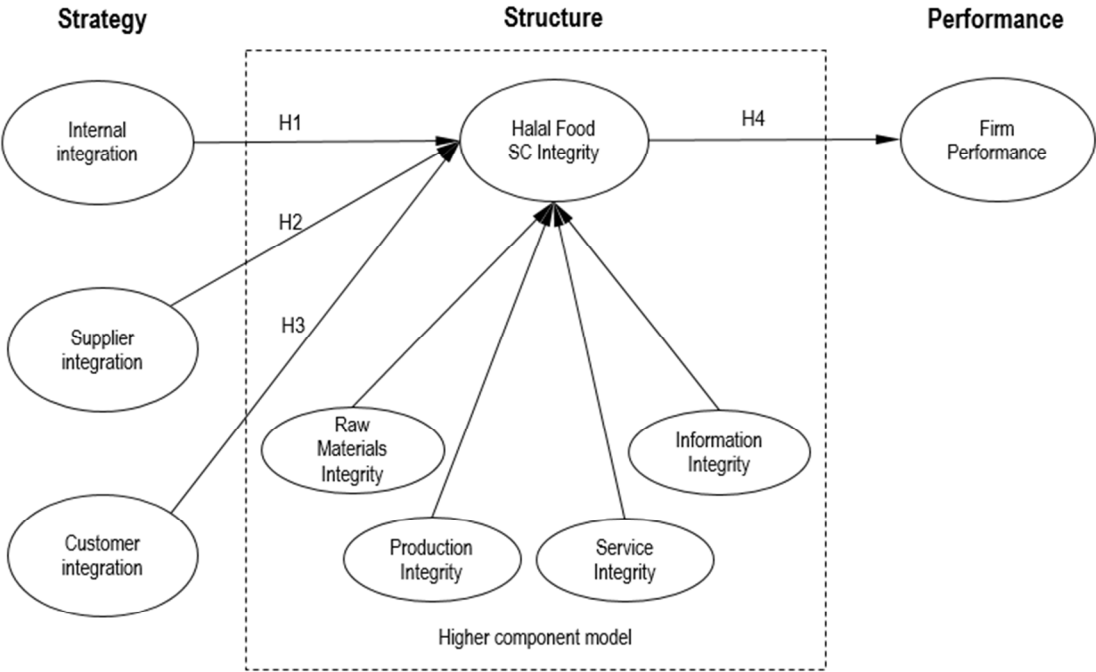
integration concept in the literature, in which the notion had seriously been considered as an important strategy in generating the flow of materials and information, and sharing core-competencies (Frohlich and Westbrook, 2001; Narasimhan and Kim, 2002; Stevens, 1989; Swink et al., 2007). More specifically, as a strategy, SC integration is regarded as a process of interaction and collaboration in which the practices in all dimensions in ensuring halal food integrity worked together in a cooperative manner to arrive at mutually acceptable outcomes for the firm, i.e. halal food integrity (Basnet, 2013; Frohlich and Westbrook, 2001; Narasimhan and Kim, 2002; Pagell, 2004).

In the simplified SC integration version suggested by Stevens (1989), there are three actors (components) in the SC that are vital in supporting the theoretical constructs: suppliers, the internal SC, and customers. Operationalisation of the SC integration researches is now focusing on more details of each component. For example, in Narasimhan and Kim's (2002) study, all three components were tested under one empirical research and an extension of Frohlich and Westbrook's (2001) work on external integration. Since this work, many SC integration studies have incorporated all components under a single study (Flynn et al., 2010; Wong et al., 2011). SC integration has since been collapsed into three typologies, namely: internal integration, supplier integration, and customer integration.

### 3.0 Research framework

Our conceptual model (as shown in Figure 1) includes SC integration, halal food SC integrity, and firm performance. In particular, SC integration is consists of internal integration, supplier integration, and customer integration (Wong et al., 2011). Meanwhile, the halal food SC integrity is conceptualised as a hierarchical component model that includes four dimensions: (1) raw materials integrity, (2) production integrity, (3) service integrity, and (4) information integrity. The conceptualisation primarily covers the food integrity definitions that was highlighted by Elliott (2013) comprising the form of the way food was sourced, procured, distributed, and being honest about the elements to consumers from the context of SC.

We underpinned the research using a strategy-structure-performance (SSP) paradigm and complementarity theory. The SSP paradigm argues the paradigm posits that when an organisation's strategy and its structure is congruent. The organisation's performance is likely to be higher than if these two do not match (Chandler, 1962; Miller and Friesen, 1984; Miller, 1996; Nakano and Akikawa, 2014; Rumelt., 1974; Wasserman, 2008). Furthermore, the SSP paradigm predicts that a firm's strategy, created in consideration of external environmental factors, drives the development of the organisational structure and processes (Defee & Stank, 2005; Galbraith & Nathanson, 1978; Galunic & Eisenhardt, 1994; Miles et al., 1978). The SC strategy requires involvement and commitment from its SC members to achieve the firms' strategic objectives. The complementarity theory purported that some of the activities/practices if being implemented together would enhance the contribution of each other and contribute to the competitive advantage (Mishra & Shah, 2009). Our study aligned with complementarity theory on the higher component model of halal food SC integrity construct suggesting that super-additive value synergies between the lower order constructs make their joint values greater than the sum of their standalone values, i.e., Value (halal food SC integrity) > Value (raw material integrity) + Value (production integrity) + Value (service integrity) + Value (information integrity).



**Figure 1:** Theoretical model

### *3.1 SC integration and halal food SC Integrity*

Eliciting the fundamentals of the SSP paradigm, Galbraith and Nathanson (1978) have defined strategy as “specific actions deriving from the strategy formulation process,” which is “the process of deciding the basic mission of the company, the objectives that the company seeks to achieve, and the major strategies and policies governing the use of the company’s resources to achieve its objectives” (Nakano and Akikawa, 2014, p.36). Galunic and Eisenhardt (1994) have defined structure in many ways: a) rigid and static features – the most basic level, where structure means formal organisational form, such as that found in a corporation’s organisational chart and in the roles and responsibility assigned to individuals/departments; b) formal processes – repetitive activities or interaction; c) informal patterns – informal communication patterns and other examples of personal interaction and social networks, which can be called (following Fombrun, 1986) socio structures; and d) an implication of organisational values – norms enveloping principles, and even culture, which can be referred to as the superstructure (Fombrun, 1986).

SSP paradigm considered the alignment between the strategy (i.e. SC integration) and structure (i.e. halal food SC integrity) as a baseline requirement for firm performance (Defee and Stank, 2005; Miles et al., 1978). Furthermore, Narasimhan and Kim (2002) suggest that by including additional variables such as structure, more valuable understanding of the relationship of SC integration to performance can be obtained. In corroboration with previous studies this established the positive impacts of SC integration in quality performance domains (ultimate goal of halal food SC integrity) (Droge et al., 2012; Frohlich & Westbrook, 2001; Huo et al., 2014; Schoenherr & Swink, 2012; Wong et al., 2011). In more specific, literature also provided evidence for the positive impact on SC value within halal food SC integrity (Ali et al., 2014). Following this paradigm, this study hypothesises that SC integration positively influences halal food SC integrity:

H1: Internal integration positively impacts halal food SC integrity

H2: Supplier integration positively impacts halal food SC integrity

H3: Customer integration positively impacts halal food SC integrity

3.2 Halal food SC integrity and firm performance

Halal food was regarded as dependent on the wholesomeness of its production in the SC (Omar & Jaafar, 2011; Regenstein et al., 2003; Tieman et al., 2012). All stages of the halal food SC are required to follow the regulations according to the Quran to ensure its integrity. Furthermore, the definition of the food integrity by Elliott (2013) was taken as having captured absolute aspects of the SC. Similarly, the farm to fork concept was noted to have been commonly used by literatures in measuring performance in food industries highlighted the importance of each actor in the complex food SC (Matopoulos et al., 2007; Powell et al., 2013; Tunçer, 2001). In light of this, we conceptualized halal food SC integrity as a formative-formative hierarchical component model due to the importance and dependencies on action and resources in each echelon of the production in the SC. As argued by Becker et al. (2012), formative-formative type model is an useful approach to structure a complex formative construct with many indicators by categorising into several sub-constructs as shown in Figure 1.

For food products, consumers regard the reputation of the firm based on experience on consumption of the past and present of a firms' product (Ahire and Dreyfus, 2000). In food, there are many criteria of expectation that influence buying decisions, such as dietary law, health, and price. Confirmation or disconfirmation of expectations is the major determinant of consumer satisfaction and of consumer intent to repurchase the product or not (Grunert, 2005). Similarly, meeting the expectation in food is crucial in developing trust among the consumers. The confirmation with the halal food specification is an important determinant of purchasing behaviour, particularly in halal food which relying on halal labelling (Alam and Sayuti, 2011; Bonne and Verbeke, 2006; Bonne et al., 2007). However, recent halal food hoax involving certified Cadbury Chocolate in 2014 shows the importance for the firm to go beyond certification in providing evidence of the integrity status of the product and eventually firm performance. Therefore, the recurrence of the consumer purchasing, loyalty and trust increase the overall firm performance through higher revenue, return on investment, and profit. In light of this, from the context of halal food, safeguarding the integrity is central to the firms' performance. To the best of our knowledge, the relationship between the practices of safeguarding the food integrity and firms' performance has yet to be tested empirically. However, the relationship

between product quality and firms' performance was evident in many previous studies (Curkovic et al., 2000; Kaynak, 2003). Thus the research in general purported positive connotation between the practices of preservation of the food integrity along the SC underlined by halal food SC integrity with firms' performance. It would be more meaningful for the research to explore the relationship with firms' performance in the practices. Therefore, the following hypotheses were proposed.

H4: Halal food SC integrity positively impacts firm performance

### 3.3 Control variable

Apart from SC integration, firm's size may also affect halal food SC integrity. Larger firms may have more resources to implement additional SC activities (Tse, Zhang, Akhtar, et al., 2016; Zhao et al., 2011). In the halal food context, the impact of ensuring SC integrity in the SC does not guarantee a perceivable impact that may not be an option to a small firm. Therefore, firm size is included in our model in controlling the SC business processes, organisational structure, and SC resource to a particular firm (Tieman, 2012; Trienekens et al., 2012).

## 4.0 Empirical study

### 4.1 Survey instrument development and deployment

In developing an appropriate measurement instrument for this study, we used two different methods. First, for more established measurement items, we adopted these from the previous researches. Second, for halal food SC integrity we developed new measurement items by deploying Menor and Roth (2007) "the front end" approach. We settled for 26 items in total for halal food SC integrity measurement items that underwent two main stages: (1) item generation and items purification, and (2) pre-testing. We generated halal food integrity items from the following main sources: 1) the MS1500:2008 (Malaysian Halal Standard), 2) food related literature (as shown in Table 1) and, 3) seven in-depth interviews with firms in various sections of Malaysian halal food. The validity of the halal food SC integrity

questionnaire items is then tested using a Q-sort method for which the placement score is greater than 70 per cent (Moore and Benbasat, 1991). Table 1 indicates the source of reference used during development of the questionnaire.

Table 1: Selected literature in developing the questionnaire

	No of items	Sources
<i>A. Reflective constructs</i>		
Customer Integration	6	Flynn et al., (2010); Narasimhan and Kim, (2002); Swink et al., (2007); Wong et al., (2011)
Internal Integration	6	Flynn et al., (2010); Narasimhan and Kim, (2002); Wong et al., (2011); Zhao et al., (2011)
Supplier Integration	6	Flynn et al., (2010); Narasimhan and Kim, (2002); Swink et al., (2007); Wong et al., (2011); Zhao et al., (2011)
Firm Performance	4	Cao and Zhang, (2011); Flynn et al., (2010); Li et al., (2006); Narasimhan and Kim, (2002)
<i>B. Formative constructs</i>		
Raw materials integrity	7	Ali et al., (2017); Magkos et al., (2006); Stanley and Wisner, (2001); Taylor et al., (2012); Tieman, (2011); Tieman et al., (2014); Tse and Tan, (2011); Zsidisin and Ellram, (2003)
Production integrity	7	Ali et al., (2017); Baş et al., (2007); Chen et al., (2014); Kumar and Budin, (2006); Luning et al., (2002); Manning and Soon, (2014); Regattieri et al., (2007); Rungtusanatham et al., (1999); Savov and Kouzmanov, (2009); Van der Spiegel et al., (2012); Wong et al., (2011)
Service integrity	7	Ali et al., (2017); Gates, (2000); Luning and Marcelis, (2007); Medeiros et al., (2012); Parasuraman et al., (1985); Resende-Filho and Hurley, (2012); Talib and Johan, (2012); Tieman and Che Ghazali, (2013); Tieman et al., (2014); Voss et al., (2005); Yin and Yang, (2009)
Information integrity	5	Ali et al., (2017); Aramyan et al., (2007); Department of Standards Malaysia, (2009); Houghton et al., (2008); Jackson, (2004); Taylor et al., (2012); Wong et al., (2011)

The questionnaire items were reviewed by three academics and three industry practitioners to ensure the content validity. In total, as shown in Tables 3 and 4, 48 (excluding 5 questionnaire items for global measurement correlation purposes in determining formative construct reliability and validity) the questionnaire items were asked of respondents using a seven-point Likert-scale indicating the extent of importance of the each questions to the firm, for which 1 signifies not at all and 7 signifies to great extent. Since the sample of this research is a Malaysian halal industry, the questionnaire was translated into Malay language with help of leading scholar in Malaysia, to ensure compatibility with the industry. Following the translation process described by Flynn et al. (2010) the Malay questionnaire was retranslated into English by a professional translator to confirm the items accurately reflect the original meanings.



#### 4.2 Data collection

This study focused on the perspective of the focal firm practices in safeguarding the halal food SC integrity. Therefore, the unit of analysis of this study was the focal firm/ brand owner of a product. Directors, senior managers and halal officers were the targeted respondents for the survey. It was viewed that the research objectives would be best achieved based on the responses from relevant managers, as food integrity is a diverse set of practices, i.e. procurement, production, service and sales. As the halal industry in Malaysia is overseen by the government, firms are required to appoint at least one Muslim halal executive officer or establish an internal halal committee which consists of Muslim personnel in ensuring the effectiveness of the implementation of halal control system. Similarly, an establishment of internal halal committee is applied as a medium of information sharing within the firm. Therefore, responses from the targeted respondents were seen as sufficient in answering the research inquiry. In total, data were collected through a survey of Malaysia halal manufacturing firms within a period of nine months. A total of 275 out of 620 survey questionnaires sent were received, yielding a response rate of 44.3 per cent. The data were then coded, examined and purified to ensure the quality of data for further assessment. In the end, there were 254 valid questionnaires when 21 responses were eliminated. Table 2 shows the description of the usable questionnaire for further analysis.

Despite the high response rate, we analysed the non-response bias by confirming any significant differences between 50 of early respondents and 50 of later respondents using a Mann-Whitney U test (Lo and Power, 2010; Swafford et al., 2006). The results indicate no statistical differences between the early responses and later responses as the p-values were 0.402, 0.262, 0.472, 0.155, and 0.390 for number of employees, sales revenue, and number of products respectively, all of which were greater than  $p < 0.05$ . In addition, as the study used seven-point Likert scales and responses are from a single informant of a focal-firm, we deployed Harman's one factor test in confirming non-existence of common method bias (Kristal et al., 2010; Podsakoff et al., 2003). The results show that the total variance of the first factor was 36.1 per cent, thus concluding the common method variance is not serious in this study.

Table 2: Respondent's demographic characteristic (N=254)

	Number of firms	Percentage
<i>Firm size (number of employees)</i>	254	100
<200	33	13
>200	221	87
<i>Annual revenue (USD-million)</i>	254	100
<1	163	64
1-3	41	16
3-5	20	8
More than 5	30	12
<i>Job position</i>	254	100
Owner	32	12
Director	45	18
Manager	73	29
Halal Executive	104	41
<i>Number of Products</i>	254	100
1-4	76	30
5-9	71	28
10-15	31	12
More than 16	76	30

4.3 Data analysis

SmartPLS package 2.0.M3, a variance-based structural equation modelling (SEM) software, was used to test hypotheses (Ringle et al., 2005). Partial Least Square (PLS) SEM is selected because it can accommodate conceptualised formative measures constructs of the food SC integrity whereas the formative construct in covariance-based modelling often results in unidentified models (Hair et al., 2014; Jarvis et al., 2003; Peng and Lai, 2012).

The measurement model of the study is summarised in Tables 3 and 4 (reflective and formative constructs, respectively). For the reflective construct, all composite reliability values that were 0.911 or higher were taken to indicate internal consistency reliability. AVE for all constructs were higher than 0.633 and exceeded the threshold value (>0.5), showing convergent validity. All items loaded significantly (>0.7) on their posited construct with the exception for CI1 but this was retained as the composite reliability and AVE was already above the threshold value and the item’s measurement would be important for content validity (Peng & Lai, 2012). Discriminant validity is shown in Table 5, where the square root of the AVE value is the highest diagonal construct.

**Table 3:** Reflective construct's measures

Reflective Constructs		Loadings	Composite Reliability	AVE
Customer Integration	CI1	0.684	0.911;	0.633
	CI2	0.747		
	CI3	0.796		
	CI4	0.820		
	CI5	0.863		
	CI6	0.847		
Internal integration	INT11	0.766	0.926	0.676
	INT12	0.763		
	INT13	0.853		
	INT14	0.860		
	INT15	0.841		
	INT16	0.844		
Supplier integration	SI1	0.805	0.937	0.712
	SI2	0.850		
	SI3	0.829		
	SI4	0.887		
	SI5	0.855		
	SI6	0.834		
Firm performance	FP1	0.891	0.937	0.787
	FP2	0.926		
	FP3	0.864		
	FP4	0.866		

For the formative construct, the examination of statistical condition was carried out; the global measurement correlations near to the threshold value ( $>0.8$ ) indicated convergent validity. For collinearity issues, all tolerance (VIF) values were higher than 0.375 (lower than 2.664), exceeding the threshold value of 0.33 ( $<3.03$ ) (Diamantopoulos and Siguaw, 2000). All the items were statistically supported either by significance outer weight, which represented the item's relative importance to the construct or by the value of outer loading which was more than 0.5 that signified the absolute importance (Hair et al., 2014)

**Table 4:** Formative construct measures

Formative construct		Outer weights	Loadings	GMC	Tolerance	VIF
<i>A. Lower order constructs</i>						
Raw materials integrity	RMI1	0.334***	0.768***	0.827	0.619	1.615
	RMI2	0.024 <sup>ns</sup>	0.691***		0.483	2.070

		RMI3	0.316***	0.850***		0.607	1.647
		RMI4	0.111*	0.640***		0.600	1.667
		RMI5	0.181***	0.721***		0.307	3.259
		RMI6	0.159**	0.797***		0.332	3.009
		RMI7	0.194***	0.661***		0.657	1.521
	Production integrity	PI1	0.071 <sup>ns</sup>	0.698***	0.768	0.649	1.540
		PI2	0.423***	0.802***		0.703	1.422
		PI3	0.183***	0.702***		0.630	1.588
		PI4	0.079 <sup>ns</sup>	0.642***		0.540	1.851
		PI5	0.418***	0.860***		0.492	2.032
		PI6	0.071 <sup>ns</sup>	0.537***		0.412	2.426
		PI7	0.058 <sup>ns</sup>	0.569***		0.417	2.398
	Service integrity	SEI1	0.071 <sup>ns</sup>	0.743***	0.854	0.649	1.540
		SEI2	0.159*	0.812***		0.703	1.422
		SEI3	0.253***	0.771***		0.630	1.588
		SEI4	0.295***	0.823***		0.540	1.851
		SEI5	0.114 <sup>ns</sup>	0.794***		0.492	2.032
		SEI6	0.125*	0.648***		0.412	2.426
		SEI7	0.253**	0.816***		0.417	2.398
	Information integrity	INF1	0.191***	0.766***	0.840	0.466	2.146
		INF2	0.205***	0.739***		0.425	2.353
		INF3	0.164*	0.765***		0.380	2.632
		INF4	0.435***	0.768***		0.779	1.283
		INF5	0.327***	0.738***		0.710	1.409
	B. Higher order construct						
	Halal food SC integrity	RMI	0.457***	0.887***	0.781	0.502	1.992
		PI	0.195**	0.827***		0.441	2.269
		SEI	0.199**	0.744***		0.583	1.714
		INF1	0.337***	0.847***		0.485	2.062

Note: GMC= Global Measurement Correlation, VIF=Variance Inflation Factor, ns=Not significant \*p<0.10 \*\*p<0.05, \*\*\*p<0.01 at two tailed

Table 5: Inter-construct correlations, discriminant, and convergent validity

	1	2	3	4	5	6	7	8
1. Customer integration	<b>0.795</b>							
2. Firm performance	0.478	<b>0.887</b>						
3. Information integrity	0.580	0.486	<b>Form.</b>					
4. Internal integration	0.524	0.291	0.517	<b>0.822</b>				
5. Production integrity	0.581	0.473	0.626	0.464	<b>Form.</b>			
6. Raw material Integrity	0.652	0.487	0.601	0.509	0.637	<b>Form.</b>		
7. Service integrity	0.516	0.391	0.588	0.543	0.552	0.542	<b>Form.</b>	
8. Supplier integration	0.673	0.351	0.543	0.624	0.487	0.596	0.534	<b>0.844</b>

#### 4.4 Structural model

We tested our hypothesis using the two-stage approach suggested by Hair, Hult et al. (2014), because of its characteristic formative–formative hierarchical construct. Moreover, the two-stage approach was appropriate in testing the complementarity model, because the research was only interested in the value of the higher component construct (Becker et al., 2012). Given the fact that the halal food SC integrity construct included in this research was conceptualised as a higher order construct (formative-formative), the two-stage approach was considered more appropriate (Hair et al., 2014; Henseler and Fassott, 2010). The justification for the selection of two-stage approach is that the repeated use of indicators at both second and first levels of higher-order formative measures would result in the perfect or near perfect explanation of the variance (Becker et al., 2012). Consequently, according to (Ringle et al., 2012) the path relationship between any additional latent variable as predecessor and the endogenous higher order construct is always approximately zero and non-significant. Thus, as illustrated in Figure 2 of two-stage approach, the latent variable scores for lower order construct (i.e. raw materials integrity, production integrity, service integrity and information integrity) are computed in the first stage to obtain the estimates for the lower order construct variables and then being used as indicators for higher order construct (i.e. halal food SC integrity) in the second stage. As shown on Figure 2, the halal food SC integrity matches the conceptual properties of the lower order constructs, indicating that the higher order construct are statistically significant. Other than that, hypothesis testing was carried out assessing the direction, strength and level of significance of the path coefficients estimated by PLS, using the bootstrap resampling method with 5,000 resampling for the structural model (Hair et al., 2014).

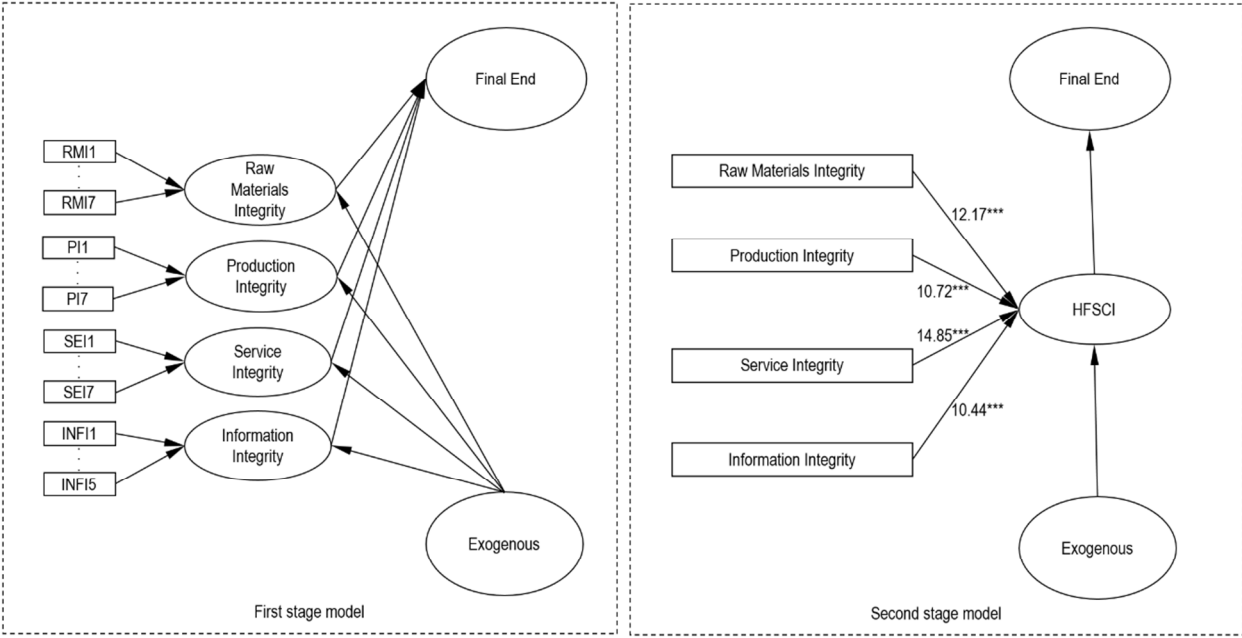
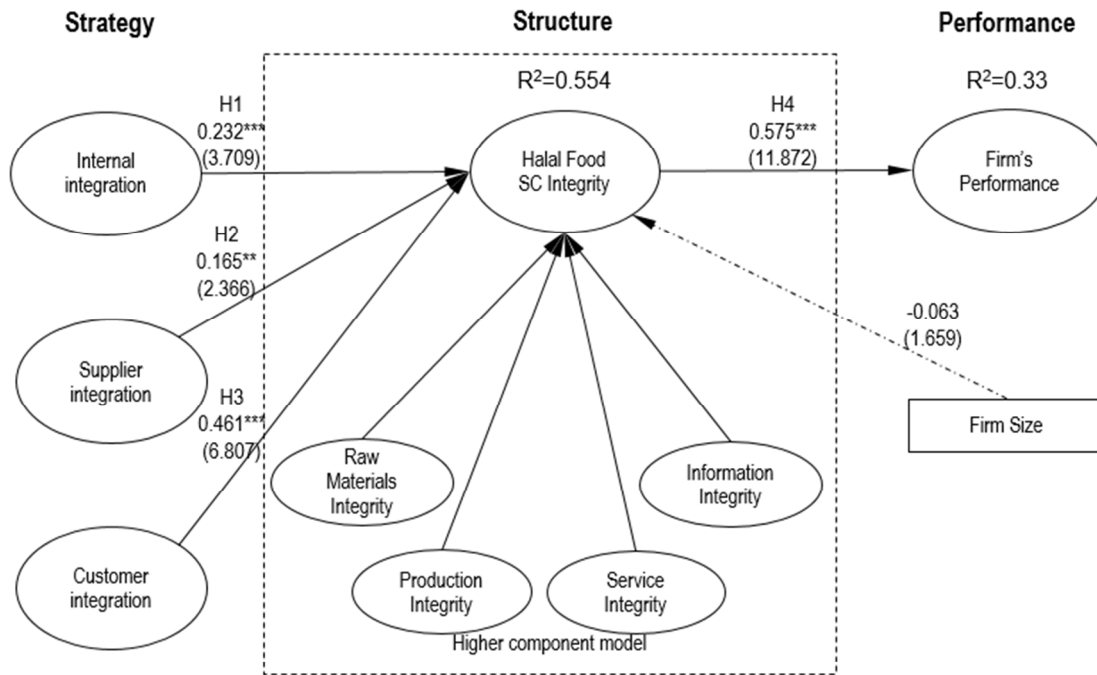


Figure 2: Two stage analysis of halal food SC integrity

First, the path coefficient between internal integration and halal food SC integrity is 0.232 and statistically significant at the level of 0.01, which therefore supports H1. Second, the standardised path coefficient between supplier integration and halal food SC integrity is significant (0.165;  $p < 0.05$ ) supporting H2. Similarly, the relationship between consumer integration and halal food SC integrity is highly significant (0.461,  $p < 0.01$ ), which supports H3. SC integration explains 55 per cent of variance in halal food SC integrity ( $R^2 = 0.554$ ). H4 is supported, suggested by the highly significant value of coefficient (0.575,  $p < 0.01$ ). The results also show that the effect of firm's size as a controlled variable in the mode is insignificant on halal food SC integrity. The result of the hypothesis testing is summarised in Figure 3.



Note: \*\* $p < 0.05$ , \*\*\* $p < 0.01$ , t-value in parenthesis, dotted line indicates insignificant relationship

Figure 3: Hypothesis testing model using PLS-SEM

## 5.0 Discussion

The major aim of this study is to establish a conceptual model adopted from a Strategy-Structure-Performance paradigm for investigating the relationships between SC integration and halal food SC integrity and the impact of halal food SC integrity on firm performance in a Malaysia context. It was purported that the strategy had a direct effect on the structure, and the structure on the performance. This means that the positive impact between the SC integration and halal food SC integrity indicated the feasibility of implementing the strategy to the structure, and when the halal food SC integration was linked with firm performance, the positive connotations indicated that the practices led to increased firm performance. The first hypothesis set up in this section was concerned with the association between the SC integration and halal food SC integrity, followed by that of halal food SC integrity and firm performance. We conceptualise the halal food SC integrity as formative-formative hierarchical component model consisting raw materials integrity, production integrity, service integrity and information integrity.



The model reveals that the strategy (i.e. SC Integration) has a significant relationship with halal food SC integrity. In addition, the halal food SC integrity explains the firm performance. The SSP paradigm considered the fit between the strategy and structure as a baseline requirement for FP (Defee and Stank, 2005; Miles et al., 1978). Following this paradigm, our test on the model predicted positive relationships between SC integration and halal food SC integrity domains, indicating fitness between the strategy and structure. In general, this finding has provided empirical evidence of governing halal food SC integrity through requiring the involvement of all players in the supply chain. Therefore, validates the notions of food integrity that has been introduced by Elliott (2014). Moreover, the study extended the view of opportunities of SC integration in safeguarding halal food integrity in the SC that is complex and full of uncertainties (Ali et al., 2014; Donk et al., 2008).

Specifically, our research findings indicate that internal integration has positive impact on halal food SC integrity. In safeguarding halal food integrity, internal integration was important at all stages of the SC. It emphasised the collaborations between the internal functions of the focal firm in fitting into the SC context, which was multidimensional and multi-tasking and which, by its nature, required the involvement of many personnel/departments. This result corresponding with literature, which in the food industry is driven by certification, internal integration is purported to be strong and crucial to satisfy the third party audit (Trienekens and Zuurbier, 2008) or any other quality management concepts (Zhao et al., 2011). The inter-departmental collaboration is often driven by strategic goals such as halal integrity.

Our results reveal that supplier integration contributes to halal food SC integrity. The drawback of the certificate overreliance, which has stopped the additional checks (i.e. on quality, or origin) (Ali et al., 2011; Manzini and Accorsi, 2013). Our results suggested a strategic collaboration with the supplier pivoted around the quality and integrity of the raw materials should be undertaken. Moreover, literature highlighted that supplier integration may help in reducing these incidents through enabling better SC transparency, visibility and traceability in mitigating the risk that causes the product recalls (Kelepouris et al., 2007; Roth et al., 2008; Trienekens et al., 2012; Tse and Tan, 2011; Tse, Matthews, et al., 2016; Zailani et al., 2010). Thus, our results corroborate with the argument that SC enhanced quality performance (Das et al., 2006; Gadde and Snehota, 2000; Grimm et al., 2014; Lee et al., 2007;

Vanpoucke et al., 2014) and extends this literature, claiming a causal relationship with increasing food integrity (Beulens et al., 2005; Storøy et al., 2013; Williams et al., 2013).

We also found that customer integration is significant with halal food SC integrity. Even though recent literature has shown an insignificant relationship between customer integration and quality (Huo et al., 2014), our research offers a different perspective from the halal food integrity context. The consumer integration is crucial in developing trust with the consumers in the food industry (Tse, Zhang, Doherty, et al., 2016). Moreover, in the big-data era, the factor of “adequacy of labelling” suggests that the dissemination of the information is brought to a new level beyond the certification. Thus, the halal industry needs to ramp-up the consumer approach.

In terms of firm performance, this study finds that halal food SC integrity has significantly positive impact. The result provides a new insight into the effect of halal food SC integrity's effect on performance. This result further confirms the work of Iranmanesh et al. (2015), who demonstrate the importance of halal integrity as one of the halal orientation strategies in Malaysia. In addition this view extends the determinants of firm performance in the halal industry beyond the certification obtainment (Ali and Suleiman, 2016; Muhammad et al., 2009).

**Table 6:** Relationship between lower order construct and firm performance

Structural link	Standard path coefficient	Significant or insignificant
Raw Material Integrity → Firm Performance	0.218 (2.03)**	Significant
Production Integrity → Firm Performance	0.154 (1.45) <sup>ns</sup>	Insignificant
Service Integrity → Firm Performance	0.057 (0.75) <sup>ns</sup>	Insignificant
Information Integrity → Firm Performance	0.230 (2.57)**	Significant

In addition, our studies enable us also to look at the complementarity of halal food SC integrity on firm performance. The complementarity theory argues that combinatorial effects of resources may enhance performance (Tanriverdi and Venkatraman, 2005), which in this study the ‘resources’ referred to are the practices of halal food SC integrity. We conceptualise halal food SC integrity as a higher order construct consisting of four lower order constructs of raw materials integrity, production integrity, service integrity and information integrity, which enable us to see separate impacts on firm performance. In fact, the four components of halal food SC integrity can share

common resources to have a better control over the quality and integrity of its SC, thereby generating synergies that enhanced FP. For example, the resources that being applied in obtaining halal certification can be a point of departure of further collaborations and integrations beyond the factory wall. Enlightened by the necessity and advantages of having complementary resources in the system, Milgrom and Roberts (1995) suggest that the synergistic value of complementary resources is larger than the sum value of each resource individually. To investigate the direct effect of the lower order construct of halal food SC integrity, we test our structural model by removing the higher component construct. Our direct effect model results are shown in Table 6 and indicate that only two out of four relationships were significant in the direct model, whereas in Figure 3 significantly higher values were shown between halal food SC integrity and firm performance. The results provide evidence of the existence of complementarity in the lower order construct of halal food SC integrity that positively impacts on firm performance. The comparison between the two models supports the theory of complementarity (Mishra and Shah, 2009; Tanriverdi and Venkatraman, 2005; Tse, Zhang, Akhtar, et al., 2016). For firms manufacturing halal food, the interdependencies of the halal food SC integrity dimensions were proven in this chapter, which provides the additional validation to the concepts such as the farm to fork and the claimant of the competition that lay within inter-SC rather than inter-firm. Following the wholesomeness production in halal food, all halal food SC integrity dimensions were regarded as a complementary set whereas employment of more halal food SC integrity practices could increase the assurance of food integrity and firm performance compared to them being individually exercised.

*5.1 Managerial implication*

This study also has important managerial implications. We suggest that the managers should adopt all of halal food SC integrity components to achieve a superior performance. Even though some of the components did not yield significant results in terms of their relationships with firm performance, these dimensions were generally related to the standardised industry requirements, i.e. certifications. This research revealed that the successfulness of safeguarding halal food integrity was affected by a complementary set of halal food SC integration practices. Managers need to acknowledge that when firms tend to solve some issues pertaining the halal integrity, all four

dimensions should be taken into consideration seriously to ensure that the cause of the dimensions are not being overlooked.

Furthermore, the complementarity of the four practices may be interconnected by the unobservable synergies of common resources in the SC. In addition, implementation of the only single dimension of the halal food SC integrity at any point of time may not be successful and could be wearisome when the sub-additives are not at the optimum level. From the resource-based view, a complementary set of halal food SC integrity has the potential to contribute to the development of rare, hardly imitable and non-substitutable competitive advantages. This study also reveals in general, the safeguarding integrity practices/efforts that by not offering a perceivable and immediate impact in the short term also plays an important role in influencing the firm performance. The fit between the SC integration and the halal food SC integrity also offer managers a means to prioritise SC integration initiatives in addressing food integrity issues in specific stages of the SC.

## 5.2 Limitation and future research

This study examines the relationship between SC integration and halal food SC integrity. In addition we investigate the impact of halal food SC integrity on firm performance. We developed a conceptual framework using the SSP paradigm as the theoretical underpinnings; hypothesising a relationship between SC integration (strategy) to synergise with halal food SC integrity (structure) and the halal food SC integrity is purported to have an influence on firm performance. The model is validated using PLS-SEM analysis using 254 samples from the Malaysian halal food industry. We found that SC integration is positively and significantly associated with halal food SC integrity, providing evidence of the synergy value between the two components. In addition, firm performance is positively influenced by halal food SC integrity. We find a complementarity of four components of halal food SC integrity, leading us to suggest that in setting up the structure managers need to consider the complete sets of halal food SC integrity so as to achieve firm performance. This study fills the research gap by: (a) providing evidence on the relationship between SC integration in determining food integrity which is not empirically tested in previous literature, (b) empirically tested

key elements of safeguarding halal food integrity that is not covered in the standards and (c) providing some practical suggestion to managers on how to achieve halal food SC integrity and their impact towards the firm performance.

Our study had limitations which can be viewed as opportunities for future research to extend our work. Firstly, this study uses a newly developed construct for halal food SC integrity, whereas future study may benefit from exploring the many contexts of operational theory and realm of discussion (Schmenner and Swink, 1998), such as the law of cumulative capabilities on halal food SC integrity. Secondly, only a single key respondent was used from each business in data collection and that may have imposed some inaccuracy, which may be even more than the usual amount of random error when rating a diverse topic of the supply-chain related questions (Cao and Zhang, 2011). Thirdly, our sample of Malaysian halal food might limit the generalisability of the results. Regarding the limitations, we suggest future research should design a study that involves multiple respondents from each participating firm in completing the view of the SC that eventually improves the accuracy of the data and reduces the random error. What is more, future research should investigate the potential effect of halal food SC integrity on different types of performance, e.g., operational performance. Furthermore, potential validity of firm performance should also be taken into account by future research. In addition, despite the fact that this research follows previous researches by using self-reporting data in measuring firm performance, future research can be improved by assessing the published financial data. Last, but not least, future research can be conducted to investigate the proposed model in different types of food context and in different settings. Therefore, the generalisability of the results can be further enhanced.

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03 December 2016

Professor Hing Kai Chan

Editor-in-Chief

*Industrial Management & Data Systems*

**Manuscript ID IMDS-09-2016-0357 entitled "Food Supply Chain Integrity: the need to go beyond certification"**

Dear Professor Chan,

First of all, we are glad to learn that reviewers strongly recognise the academic value of this manuscript. This paper aims to address the shortcomings of current control mechanisms aimed at safeguarding food integrity, by exploring the possibilities of supply chain integration in enhancing the food integrity. It examines the relationship between supply chain integration and halal food supply chain integrity and investigates the impact of halal food supply chain integrity on firm performance. It further developed a conceptual framework using the SSP paradigm as the theoretical underpinnings; hypothesising a relationship between supply chain strategy to synergise with halal food supply chain structure and the halal food supply chain integrity is purported to have an influence on firm performance. Nonetheless, reviewers gave some recommendations of the paper which need further elaboration.

Please find enclosed the revised version of the manuscript *IMDS-09-2016-0357*. We have made modifications to the paper in order to address the suggestions made by the reviewers. We outline the modifications in the following pages.

We look forward to further feedback to make the paper suitable for publication in the IMDS Journal.

Yours sincerely,

The Authors

\* *Corresponding author*

## SUBMISSION IMDS-09-2016-0357 MODIFICATIONS

The paper has undergone substantial revision and rewriting to incorporate the comments and suggestions of the reviewers. Below we outline the changes made.

**Reviewer #1**

<i>Reviewer Comments</i>	<i>Our Response</i>
<b>Originality</b> The present study investigated the supply chain integration and halal food supply chain integrity and the impact of halal food supply chain integrity on firms' performance in a Malaysian context through survey to 254 valid responses. This is an interesting piece of solid work. It is properly developed and most of the information is technically well presented. I have only some minor issues regarding the theoretical contributions and methodology.	We are happy to learn that reviewer 1 pointed out the paper is interesting, well-developed and well presented.
<b>Relationship to the Literature</b> The manuscript is putting emphasis on the fact that Malaysia's operating context is providing a fertile ground to study the impact of integration and integrity on halal on organizational performance. While that can be true, I failed to appreciate how such a context can support a substantial contribution to the field. Some explanations identified specific Malaysian context aspects but much more is needed in order to make the halal SC integrity as a key contribution to the literature. I am also underwhelm by the support provided in the introduction and the theoretical development in regards to the halal integrity impact therefore, I would strongly encourage the authors to succinctly develop the argument for the manuscript's contribution in regards to the mediating effect in the introduction.	Noted, we would like to thank the reviewer for pointing this out. For the main purpose of this study, we are interested in seeing the direct relationship between the constructs that underpinned by Strategy-Structure-Performance paradigm. In specific, the HFSCI (here structure) is not considered as mediator but the SSP paradigm argues that relationship between the strategy and structure is important for firm performance. That is the justification of the 'missing' mediating elements throughout the manuscript. In the revision, we have added a short description highlighting that the model is a direct relationship type of model to avoid similar confusion and make it clearer. Kindly refer to section 3.0, paragraphs 1 and 2 between pages 8 and 9.



<p><b>Methodology</b></p> <p>Methodology and Model estimations.</p> <p>There are a few aspects of the research methodology and the model estimation that need to be addressed before further consideration for publications. Two series of tests related to the sample and the respondents are needed. First, non-response bias tests are needed. A second series of tests is about the common method bias.</p> <p>It seems that only one person is targeted as the interviewee for each firm. Can the responses be always in accordance with the actual situation of the firm? How do you deal with the possible biases of the survey? I think more managers could be targeted as the interviewees for each firm with a separate interview. As a result, the responses could be verified with a comparison.</p>	<p>Agreed. We understood that the non-response bias and common method bias are important in quantitative analysis. In the revision, we have further highlighted this issue under Section 4.2 just before Table 2 (pg.13). Please see section 4.2, paragraph 2, on page 14.</p> <p>Moreover, we have highlighted that the target respondents of the survey are directors, senior managers, and halal officers. The actual situation of the firm is accordance to the situation of the firm since there is a need of the firm to establish halal committee that discussing on the overall operational issues that happened within the firm. Also, we have pointed out that the common method bias is not serious in this study. For detailed improvements, please refer to section 4.2, paragraphs 1-2, on page 14. Furthermore, we agree that more managers could be targeted as the interviewees, however, that requires further additional investigation that we suggesting for future research.</p>
<p><b>Results</b></p> <p>There might be several omitted variables in the model. First, size is an important control variable to be included. Looking at the literature several other variables were also considered as control including age of the company etc. While, I am not expecting all these control to be included, some control variables need to be included.</p>	<p>Noted. In the revision, we have followed the reviewer's comment and conducted more analysis (e.g., control variable, firm size). Please refer to section 3.3 on page 12 for the reason behind this selection and section 4.4, paragraph 2 on page 19 for the results.</p>
<p><b>Implication for research, practice and/or society</b></p> <p>Need to strengthen the arguments of the paper's contributions in theoretical aspect should be taken into consideration</p>	<p>In the revision, we have strengthened the theoretical contributions of this research. Please kindly refer to section 5, paragraphs 1-7, on pages between 20 and 23.</p>

<b>Quality of Communication</b> The manuscript is very well-written except on the theory part.	Thank you for pointing this out. In the revision, we have made extensive modifications to enhance the theory part of the manuscript. In particular, please see section 3, paragraphs 1-2, on pages between 8 and 9.

**Reviewer #2**

<i>Reviewer Comments</i>	<i>Our Response</i>
1. The data collection rate seems a bit low. As the authors stated that there should be at least one contact person working on halad-related issues from each company. Can authors address something on this?	We would like to thank the reviewer for pointing this out. In the revision, we have rewritten this section to make it clearer. Please see section 4.1, paragraph 2, on page 13; and section 4.2, paragraph 1, on page 14.
2. It is suggested that there should be some data systems related materials to make the paper more fit in the scope of the journal.	Noted. We have strengthened our arguments as well as enhanced our theoretical contributions through referring more up to date IMDS papers.
3. I expected that there will be some references citing the IMDS papers otherwise this paper seems to be not fit in the scope of the journal.	